

of gradation from those which had white bellies to those which exhibited the characters of perfectly typical *Mus musculus*.

I think, then, that we may safely conclude that *Mus musculus* is of at least several hundred years' standing at St. Kilda.

There is one extremely interesting point which should not be forgotten in connection with these two St. Kilda Mice, namely the fact that we have here a clear opportunity of studying the effect on two distinct species of the same genus of isolation side by side on the same island. Here we have on a circumscribed area two species in the course of evolution, the progress of which may be easily studied from time to time. The species having now been described, we may be able in 20 or 30 years' time, by comparing specimens taken then and now, to estimate the amount of change which they will in that time have undergone. It is interesting to note, however, that so far the effect of isolation on the island is not similar in the case of the two species, since apparently the Mouse which must be supposed to have been the longer time at St. Kilda is the very one which has varied in a lesser degree than that which we must regard as an introduction. For *Mus hirtensis*, which appears to have been on St. Kilda since that island was in connection with the mainland, is certainly not much more different from *Mus sylvaticus* than is *Mus muralis* from *Mus musculus*, yet *Mus muralis* can only be an introduced species of at most a few hundred years' standing. Nothing can give stronger emphasis to the fact that different species possess different powers of variability and follow a different course of evolution, so that it seems that we cannot predict what will happen under certain circumstances to one species from our experience of what has happened to another. Every species, it would appear, has its own modes of evolution and development, which are peculiar to it and to it alone.

EXPLANATION OF PLATE IX.

Fig. 1. *Mus hirtensis*, p. 81.

Fig. 2. *Mus muralis*, p. 81.

4. Notes on the Internal Anatomy of *Notornis*. By W. BLAXLAND BENHAM, D.Sc., M.A., Professor of Biology, University of Otago, Dunedin, New Zealand.

[Received December 7, 1898.]

Early in August of the present year, 1898, I had the opportunity of examining the anatomy of that rare flightless Rail, *Notornis mantelli*, of which only three previous specimens had been obtained during the last 50 years, so that it has been regarded by European zoologists as probably extinct. Thus Gadow says, in Bronn's 'Thierreich': "kürzlich ausgestorben" (Systematic part, p. 182).

The previous specimens did not reach the hands of naturalists in a condition fit for examination, but this fourth one arrived in a

perfectly fresh condition, and I at once proceeded to examine those parts of the viscera which might have interest to the systematist. As I am not an "ornithologist," and have but little experience in the subject of avian anatomy, it may be that I have omitted to note some special points of importance: for such omissions I must apologize; and as the viscera have been preserved, it may be possible to rectify the omissions at some future time.

The bird was a young female, in which the ovary was very small, none of the eggs being more than one-eighth of an inch in diameter. This fact is of itself of some interest to naturalists, for the sex of the previous specimens had not been determined; and the coloration of this specimen is so similar to that of the skin in the Dresden Museum that there can be no doubt but that it, too, was a female, as also is one of the skins in the British Museum; the other skin appears from Buller's account to be of brighter plumage, and is presumed by him to be a male.

A full account of the colour of *Notornis*, as well as of the history of the previous specimens, will be found in Sir Walter Buller's 'History of the Birds of New Zealand'; and an account of the history of this fourth specimen and the external appearance of this fourth skin was read by me at the meeting of the Otago Institute in September, and will be published in the 'Transactions of the New Zealand Institute' for the current year. In the present paper I confine myself to facts of internal anatomy. The viscera to which I directed my attention were: (a) the alimentary tract, (b) the tongue, (c) the larynx, (d) the syrinx. Of all these structures I have made careful measurements and drawings, some of which accompany this paper.

(a) *The Alimentary Tract*.—The œsophagus and glandular stomach present no feature of special interest; the gizzard, of the type usual in graminivorous birds, is of large size, measuring $3\frac{1}{4}$ inches by $2\frac{1}{4}$ inches (the length of the entire bird from the tip of the beak to the tip of the rectrices is 23 inches). The intestine is 48 inches in length from the pylorus up to the cloaca.

The duodenum is $\frac{3}{4}$ inch across, and this loop measures $5\frac{1}{2}$ inches. The intestine is thrown into a few major folds, which are shown in fig. 1 (p. 90). Unfortunately the mesentery had been slightly injured by the taxidermist in removing the viscera, but I believe that the figure is a true representation of the convolutions. I need not describe them in detail, as the figure is sufficiently explicit, and I leave ornithologists to determine the systematic value of the arrangement of these coils, which appear to agree closely with the scheme given by Mitchell for the Rails¹.

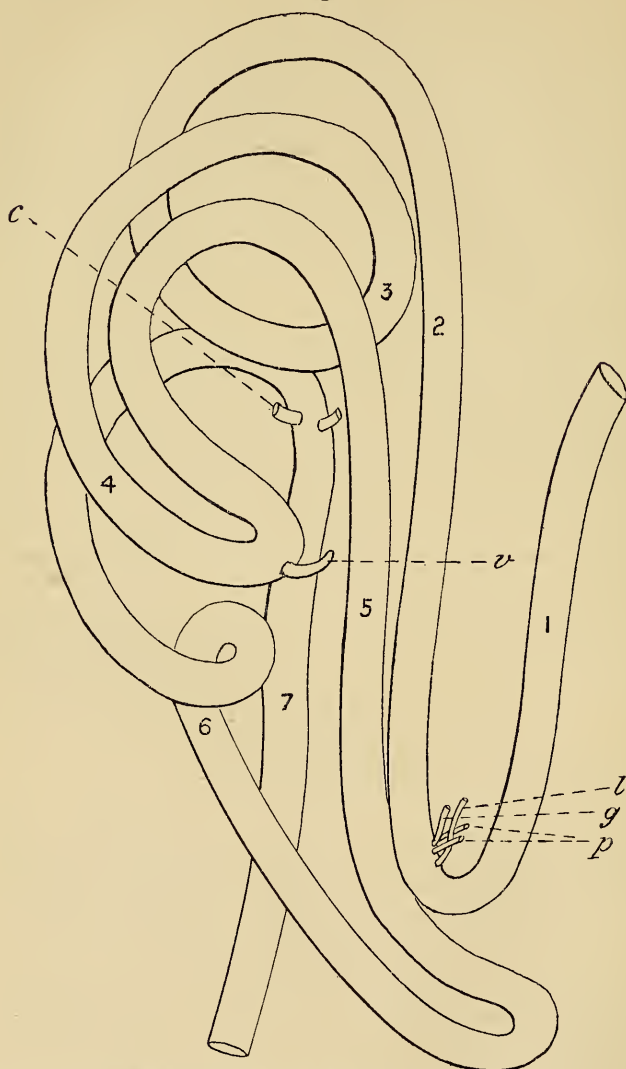
The remains of the vitelline duct (v) is $\frac{1}{2}$ an inch in length, and arises just 24 inches from the pylorus, that is halfway along the length of the intestine.

The paired cæca are of large size: they arise (c) about 6 inches from the posterior end of the gut, and each measures 9 inches in length. It is at first much narrower than the intestine, and this

¹ Mitchell, Proc. Zool. Soc. 1896, p. 49.

proximal portion is slightly convoluted, but soon dilates to form a wide thin-walled terminal sac.

Fig. 1.



A semidiagrammatic plan of the intestinal coils of *Notornis*.

The loops are numbered: 1, the proximal limb, and 2, the distal limb of the duodenum; 7, the rectum; *c*, origin of caecum; *g*, entrance of duct from gall-bladder; *l*, duct from liver; *p*, pancreatic ducts; *v*, remains of vitelline stalk.

The gizzard and duodenum were filled with short pieces of sedge (*Carex*) and *Uncinia*.

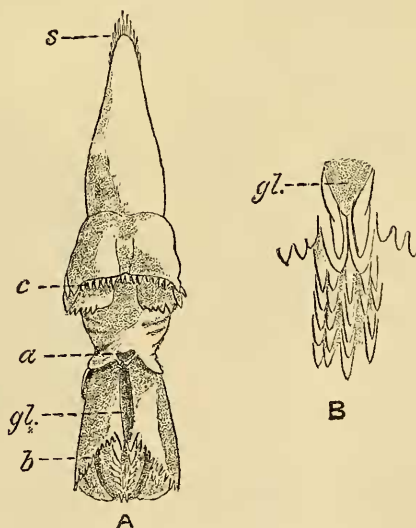
The liver-lobes present the usual inequality. The gall-bladder is an oval sac, completely outside and free from the liver; there are the two usual ducts, one the "cystico-enteric," the other the "hepato-enteric." The pancreas is provided with two ducts, one from the dorsal lobe and the other from the ventral lobe, as we may term those parts which lie on each side of the mesentery, as the duodenum lies spread out in the normal way, though no doubt right or left would be more appropriate.

The ventral lobe of the pancreas terminates anteriorly in a freely projecting finger-like process.

Both the ducts arise at the hinder end of the pancreas, pass directly across the mesentery, to open close to the two liver-ducts into the distal limb of the intestine (fig. 1, *l*, *g*, *p*).

(b) *The Tongue* (fig. 2).—The acute tip of the tongue is beset with a series of short brown cylindrical horny spines (*s*), which

Fig. 2.



A. The tongue and neighbouring parts of the floor of the mouth of *Notornis* (nat. size).

B, enlarged view of the postglottidean longitudinal rows of papillae.

a, epiglottis; *b*, oblique postglottidean papillae; *c*, transverse preglottidean papillae; *gl.*, glottis; *s*, brown apical spines.

are largest at the tip, and decrease in length along the sides, where they soon cease.

At the base of the tongue is a transverse, slightly curved ridge, beset with a series of fourteen hard, conical, white papillae (*c*) or

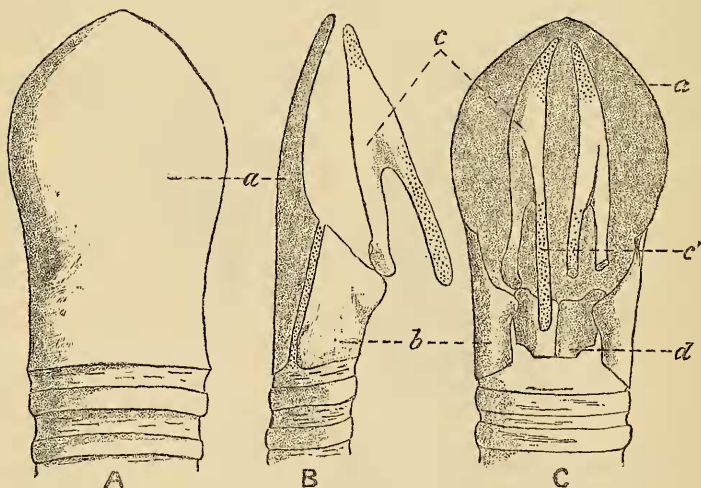
blunt spines, of irregular size, small and large, more or less alternately arranged.

At each end of this transverse row of preglottidean spines the ridge bends sharply downwards vertically, and then curves inwards towards the middle line: it here carries a series of seven similar, but larger, conical papillæ, arranged one above the other, decreasing in size ventrally and ultimately dying out.

The glottis (*gl.*) appears to be provided with a rudimentary "epiglottis" (*a*) in the form of a small rounded nodule of cartilage. Behind the glottis there is on each side a very obliquely placed ridge, carrying a row of about a dozen small postglottidean papillæ (*b*), of which the mediad is the largest. Behind this large papilla is a longitudinal series of postglottidean spines or papillæ of the same character but longer and softer (see fig. 2, B), which are directed backwards, each spine lying above the succeeding one. These are in three rows, a median and two lateral rows. The median row consists of five papillæ; the lateral rows are unsymmetrical, there being on the right two couples and two single papillæ, on the left five couples.

(c) *The Larynx* (fig. 3) is imperfectly ossified and suggests,

Fig. 3.



The skeleton of the larynx of *Notornis* (enlarged).

A, ventral view; B, side view; C, dorsal view: *a*, the so-called "thyroid"; *b*, its posterior incurved portion; *c*, arytenoid; *c'*, its mediad limb supporting the margin of the glottis; *d*, "cricoid." In C the details of the right side are put in for the sake of symmetry; as a matter of fact, I dissected only the left side: the right arytenoid is represented as being cut short so as to show more of the cricoid. The tracheal rings are only diagrammatically indicated, their overlap being omitted. Cartilage is dotted.

as does the ovary, the immaturity of the bird. The so-called "thyroid" (which, according to Gadow, is the "cricoid" of recent authorities) is a nearly flat, somewhat spoon-shaped, plate (*a*), slightly convex ventrally, especially posteriorly; it is feebly pointed in front and truncated behind. The posterior half of its lateral margin is slightly upcurved and forms a cartilaginous ridge, with which is articulated a second bony plate (*b*), which is separated from (*a*) by a narrow cartilaginous area. The posterior piece (*b*) belongs apparently to the "thyroid," with which it becomes continuous, according to Tiedemann and Duméril, in very old birds. The piece *b* curves sharply inwards dorsally, and articulates with the side of a small median bone (*d*), the "cricoid" (or "pro-cricoid" of Fürbringer); it is hexagonal in shape, with the anterior side largest and a groove along the middle; its lateral edge articulates with the incurved margin of the plate *b*, while its antero-lateral angle of each side supports the hinder end of the "arytenoid" (*c*).

The arytenoid is again imperfectly ossified, as is indicated in the figure; it is a Y-shaped bone, with the middle limb directed forwards, and it appears to be here connected with the epiglottis, but of this I am uncertain. I only cleaned the left side of the larynx, as of the syrinx, as I did not wish to do more injury than was necessary.

The main part, and stronger half, of the bone articulates with the "cricoid," while the feebler, and at present cartilaginous, limb (*c'*) of the Y supports the margin of the glottis and ends freely behind.

As to the musculature of the larynx, I am unable to say anything, as I did not think any important point would be presented by its arrangement.

The rings of the *trachea* are only partially ossified; they overlap one another alternately right and left (fig. 4), and are, of course, narrower in the middle line dorsally and ventrally. Overlying this region, on the dorsal line, is a small nodule of cartilage (*x*).

(*d*) *The Syrinx* (figs. 4-6, pp. 94, 95, 96) consists of seven closely-apposed rings (*a-g*), of which the fourth (*d*) carries the pessulus, so that I presume, from Gadow's account of the structure in general, this ring should be regarded as the last tracheal. If this be the case, then four of the syringeal rings are tracheal and three are bronchial.

The "membrana tympaniformis externa" is supported by the last syringeal ring (*g*) and by the three following bronchial rings (I, II, III).

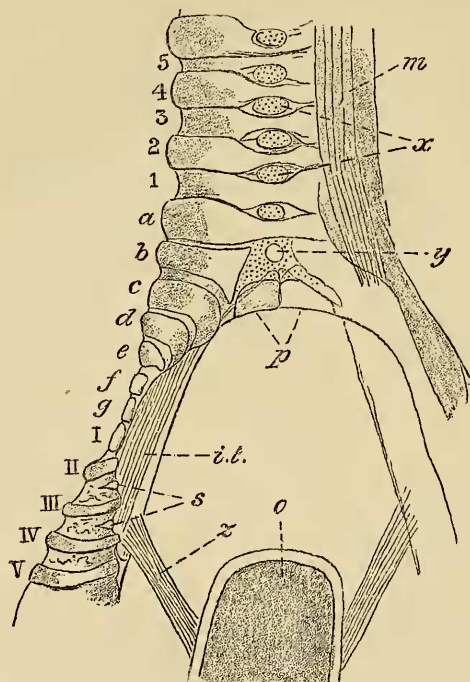
The rings of the syrinx (*a-g*) are in the present specimen separate, owing no doubt to the growth of the bird.

As the arrangement of these rings is unlike anything figured by Gadow in "Bromm," I will describe the syrinx in some detail.

The ring *a* differs little from the preceding normal tracheal ring (1), which, indeed, overlaps it on the right side. The next ring (*b*) is, however, incomplete dorsally, where its end is enlarged and abuts upon a cartilaginous plate, in the centre of which is a small nodule of bone (*y*).

The ring *c* is somewhat larger, and its dorsal ends curve round on to the inner surface of the bronchus and here cease. (Is it therefore a bronchial ring?) On the ventral middle line it is slightly dilated.

Fig. 4.



The syrinx of *Notornis*, dorsal view ($\times 8$).

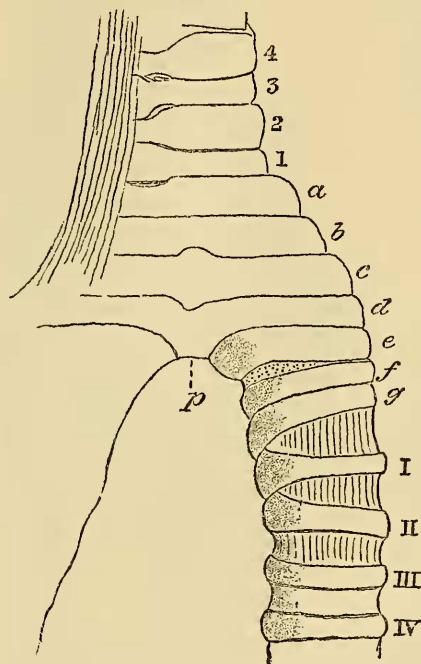
a-g. The modified rings of the syrinx; 1-5, normal tracheal rings; I to V, normal bronchial rings; *i.t.*, membrana tympaniformis interna; *m*, tracheo-bronchial muscle; *o*, portion of oesophagus; *p*, origin of pessulus; *s*, *x*, accessory interannular cartilaginous nodules; *y*, ossicle; *z*, muscle from oesophagus to bronchus.

The fourth syringeal ring (*d*), when seen from the side, passes straight across, and lies almost horizontally. It has a greater diameter than the preceding, and projects as a knob ventrally. Here it is produced backwards (*p*) and is continued dorsally between the two bronchi to form the pessulus. But the dorsal end of this same ring (*d*) curves round the bronchus on each side as *c* does, and, like it, ceases against the "membrana tympaniformis interna."

The pessulus, which is directly connected with the ring *d* at its ventral end, terminates dorsally against a couple of bones situated at the angle formed by the two bronchi, which appear

to be independent of any ring, and present a concavity on their outer faces. It is, however, possible that when ossification is complete these two bones will ankylose with the ends of the ring *b*.

Fig. 5.



The syrinx of *Notornis*, ventral view (slightly more enlarged than fig. 4).

Letters as in fig. 4.

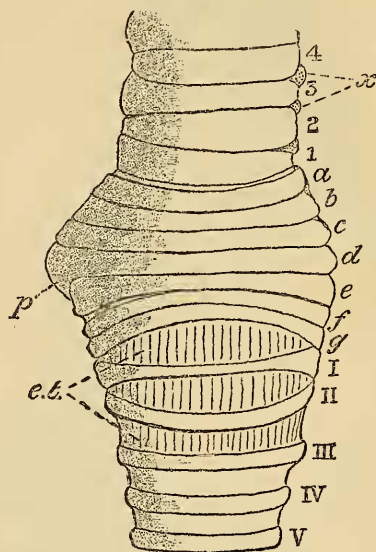
The remaining syringeal rings (*e, f, g*) call for little remark. They are all closely apposed, and ventrally curve very sharply round the bronchus to reach the membrana tympaniformis interna, while dorsally the incurved region is very slight.

The ring *g*, owing to its curvature, is much arched forwards at the side, so that between it and the first unmodified bronchial (I) there is a considerable space, across which is stretched the membrana tympaniformis externa. This ring (I) is almost straight, while II is concave upwards; between them is also the thin membrane: another part of it lies between II and III, but this space is much narrower than either of the preceding. On the dorsal side between the ends of each of the rings II/III and III/IV is a small ossicle (*s*).

Passing from the syrinx itself, I would refer to a slip of muscle

which does not appear to be mentioned by Gadow; that is, a bundle (*z*) which passes from the hinder part of the membrana tympaniformis interna to the œsophagus. I cannot distinguish a "bronchiodesmus," unless this is some modification of it. The only muscle on the outer surface of the syrinx is the "tracheo-bronchialis," which is attached to the ring *d*.

Fig. 6.



The syrinx of *Notornis*, from the left side ($\times 8$).
e.t., membrana tympaniformis externa. Other letters as in fig. 4.

A comparison of the syrinx with the figures given by Gadow in Bronn's 'Thierreich,' as well as with those described from time to time by Beddard, shows that in this particular *Notornis* is very peculiar.

5. Descriptions of two new Lizards from the Interior of British East Africa. By G. A. BOULENGER, F.R.S.

[Received January 6, 1899.]

(Plate X.)

LACERTA JACKSONI. (Plate X.)

Head rather long, much depressed. Rostral not entering the nostril; a single postnasal; four upper labials anterior to the subocular; a series of granules between the supraoculars and the supraciliaries; occipital moderate, a little shorter than the inter-